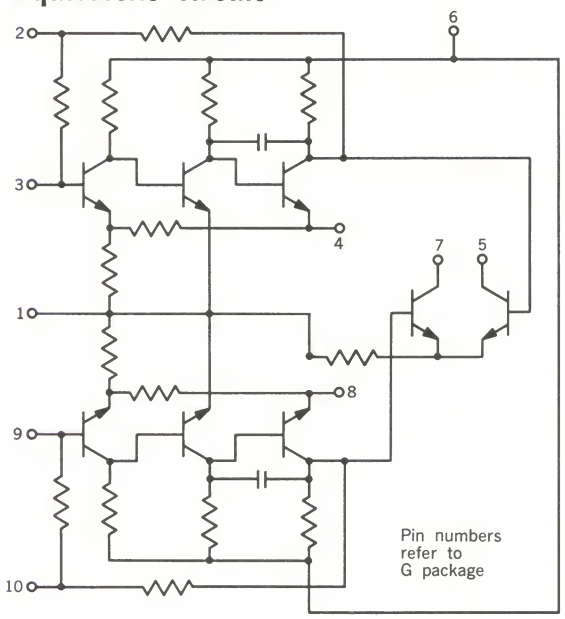
integrated circuits

low level audio amplifier

technical data 91-206

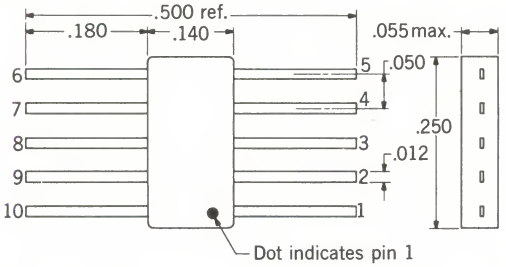
WC 183G
WC 183T

Equivalent circuit



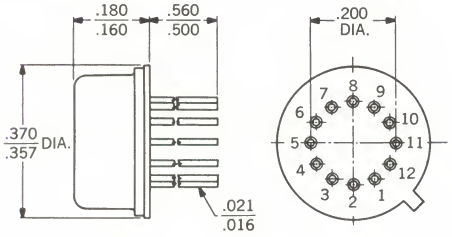
Package

G style FLAT-PAK (EIA TO-89)



1. Common
2. Bypass
3. Input
4. Volume control
5. Output
6. V_{cc}
7. Output
8. Volume control
9. Input
10. Bypass

T style (EIA Registration Pending)



1. Common
2. Bypass
3. Input
4. Volume control
5. Output
6. No connection
7. V_{cc}
8. Output
9. Volume control
10. Input
11. Bypass
12. No connection

General description

The WC 183 general purpose low level audio amplifier consists of an eight transistor balanced circuit with internal DC feedback fabricated as one monolithic silicon chip. A three stage class A preamplifier gives high gain, and is followed by a class B output stage to provide high overall efficiency. The unit has a very low quiescent current drain and provides excellent performance on high gain, low power requirements. A unique feature is the ability of the amplifier to provide high gain, using only a single one cell battery for power.

Application

This amplifier is suggested for radio, recording, and other audio applications in the milliwatt range. The use of an optional rolloff capacitor makes it ideal for audio use in voice communications equipment where limited frequency response is desired. For higher fidelity audio applications, a simple feedback network extends the flat frequency response to well beyond the audio range. Its input and output connections and impedances are compatible with readily available audio transducers.

In addition to its many purpose audio applications, the WC 183 amplifier performs unusually well in battery powered applications, and in particular as a hearing aid amplifier. In this application, its high gain at low voltage, low quiescent current drain and highly efficient class B output stage result in improved sound quality and significant increased battery life.

Design features

- 90 db gain at V_{cc} of 4.5 volts
- 60 db minimum gain at V_{cc} of 1.55 volts
- Quiescent current less than 1 ma
- Efficiency 55%

Reliability assurance

Mechanical and environmental reliability assurance EVERY unit receives

- High temperature storage bake at +150°C
- 20,000 G centrifuge
- Hermeticity tests
- Failure rate is less than 0.01% per 1000 hours from current life test data

Absolute maximum ratings

Parameter	Symbol	Value	Units
Power supply voltage	V_{cc}	9	volts
Power dissipation	P_D	100	mw
Storage temperature	T_{stg}	−65°C to +125°C	°C
Operating temperature	T_{opg}	−55°C to +75°C	°C

Thermal impedance

Conditions	Value	Units
Free air at 25°C	265	°C per watt
Infinite heat sink at 25°C	35	°C per watt

Typical electrical characteristics

(at 25°C and P_{out} = 3.0mw unless stated otherwise)

	V_{cc} = 1.55 volts			V_{cc} = 4.5 volts			
Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Power output	3.0			35	45		mw
Voltage gain (pins 4 and 8 shorted)	60	72		84	94		db
Battery current		4.3	5.0		5.2	9.0	ma
Quiescent current		0.9	1.5		3.5	8.0	ma
Total harmonic distortion		6	8		7	9	%
Noise voltage at output *		3	10		3	12	mv
Frequency response (3 db down points)							
Uncompensated	12,000		300	10,000		500	Hz
With .05 μf rolloff capacitor between pins 5 and 7	4,200		300	3,000		500	Hz
Input impedance		40			40		KΩ
Volume control range	25	35		25	52		db
Efficiency		55		45	68		%

* Gain ≤72 db

Test Circuit

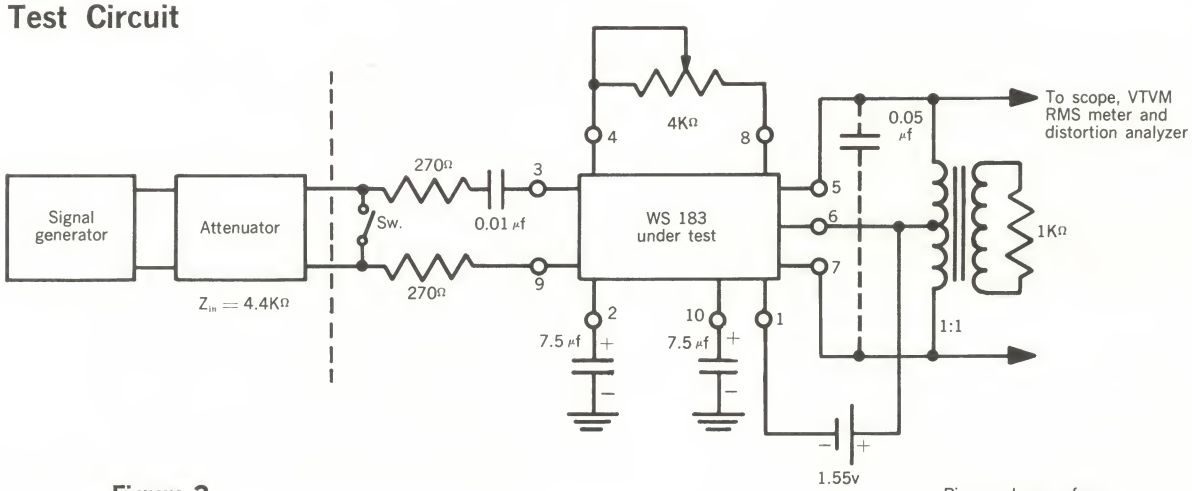
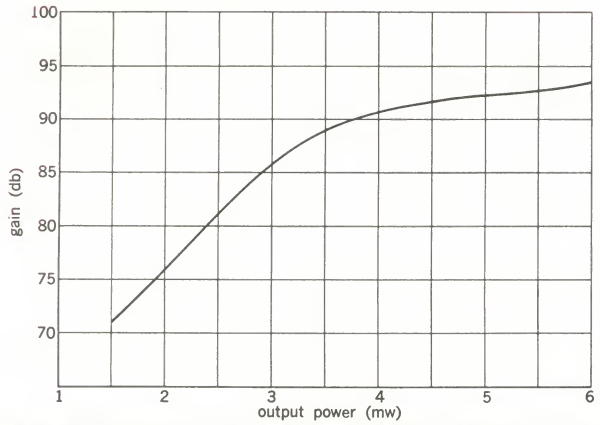


Figure 3

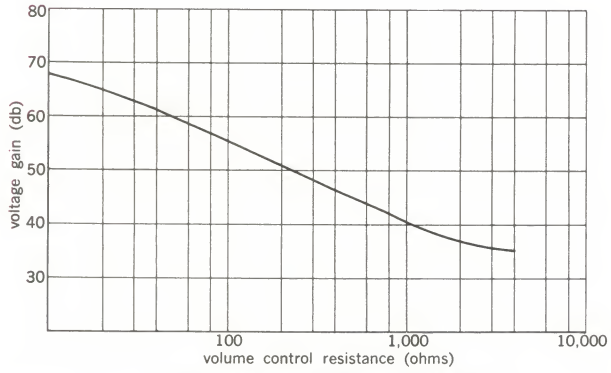
Typical electrical characteristics

(at 25°C and at V_{cc} = 1.55v and 3.0mw unless stated otherwise)
(Refer to Fig. 3 for test circuit)



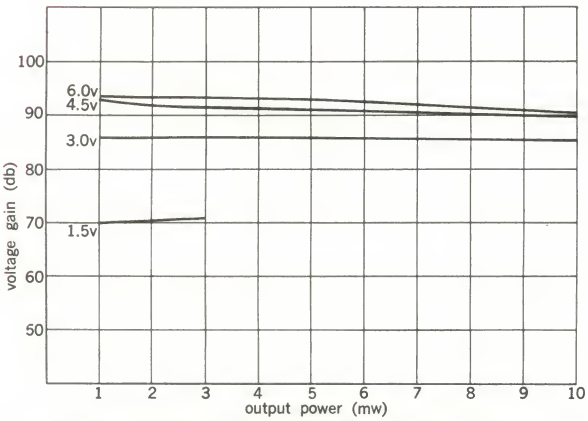
GAIN VS SUPPLY VOLTAGE AT 3 MW POWER OUTPUT

Figure 4



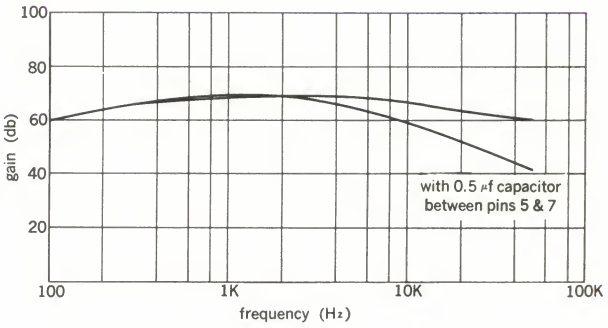
VOLUME CONTROL RANGE

Figure 5



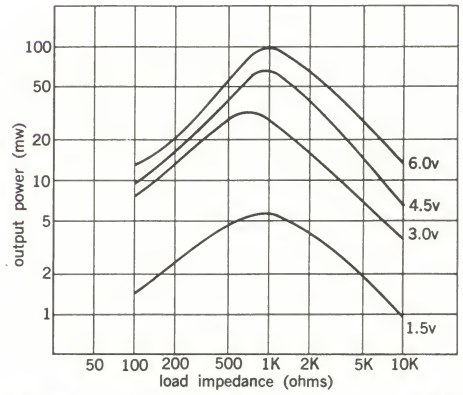
GAIN VS POWER OUTPUT AS A FUNCTION OF V_{cc}

Figure 6



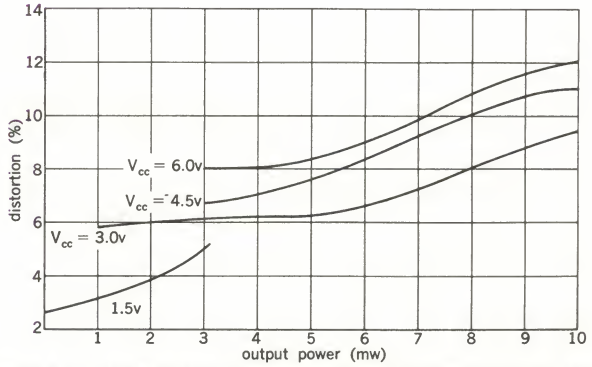
FREQUENCY RESPONSE CHARACTERISTIC

Figure 7



MAXIMUM OUTPUT POWER VS LOAD IMPEDANCE

Figure 8



TOTAL HARMONIC DISTORTION VS POWER OUTPUT

Figure 9

Typical applications

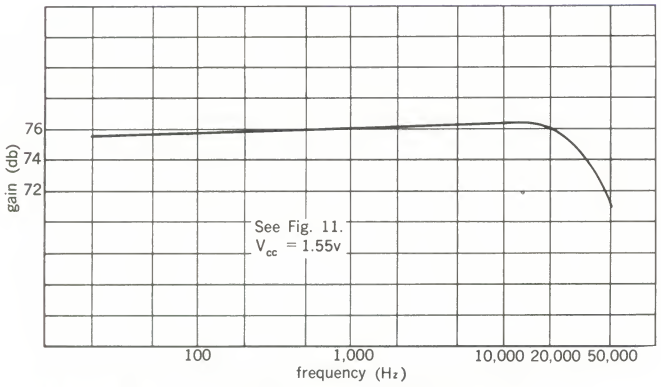
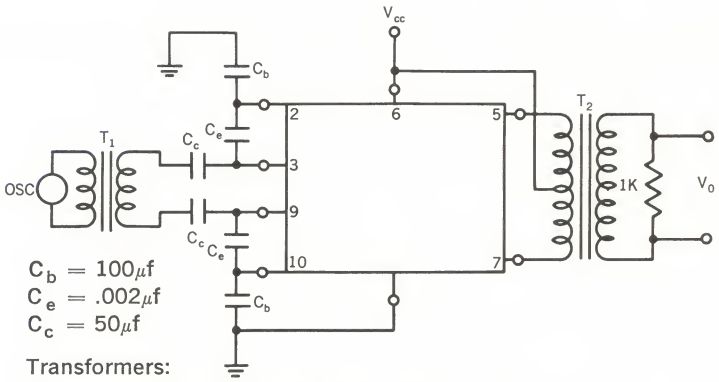


Figure 10 FREQUENCY RESPONSE

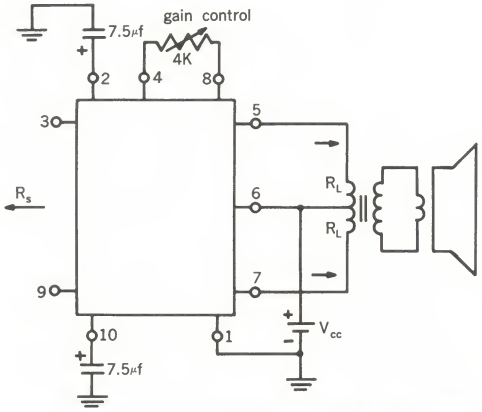


C_b = 100μf
C_e = .002μf
C_c = 50μf

Transformers:
T_1 — General Radio type 941-A or equivalent
T_2 — Peerless type E-204-D or equivalent

WIDE BAND AMPLIFIER

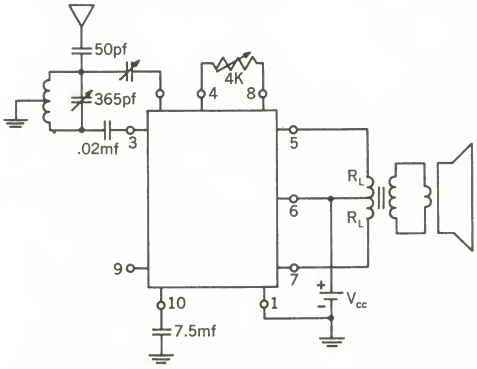
Figure 11



R_S — Typical 5000Ω AC and 600Ω DC
R_L — Typical 250Ω AC @ 1KC

AUDIO AMPLIFIER

Figure 12



R_L — Typical 250Ω AC @ 1KC

BROADCAST BAND REGENERATIVE RECEIVER

Figure 13

Pin numbers refer to G package

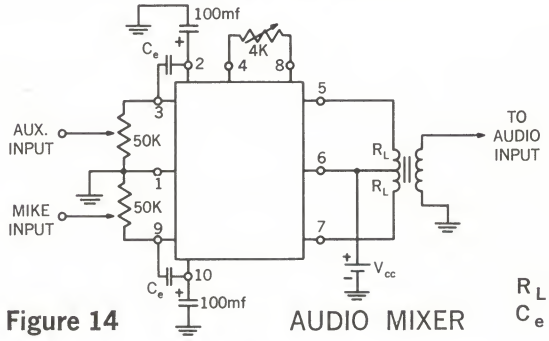


Figure 14 AUDIO MIXER

R_L — Typical 250Ω AC
C_e — Equalization capacitor

References:
Hellstrom, M. J., and Hsieh, J. J. "A Monolithic Silicon Class B Hearing Aid Amplifier." WESCON, San Francisco, 1965.
Hellstrom, M. J. "A Family of Integrated Class B Hearing Aid Circuits." National Electronics Conference, Chicago, 1965.

All values shown subject to design change for product improvement.

Westinghouse Electric Corporation / *MOLECULAR ELECTRONICS DIVISION*

BOX 7377 ELKRIDGE, MARYLAND 21227 • BOX 305 NEWBURY PARK, CALIFORNIA 91320

PRINTED IN U.S.A.

Here's a new ~~pair of~~ linear IC's to cover the range of commercial usage from DC to ~~85~~ Audio MHz. Use WC 1146 for rf, if, oscillator-mixer and detector stages. Use WC 183 for audio stages. They cost only $7.50 each in 50 piece quantities from distributors as listed on reverse side.

In integrated circuits, the winning chips come from Westinghouse

#9-466

Westinghouse Electric Corporation
Molecular Electronics Division
Box 7377
Elkridge, Maryland 21227 Phone: (301) 796-3666 TWX: (301) 761-4340

Westinghouse Sales Offices

Alabama, Huntsville ..... (205) 881-2591
Arizona, Phoenix ..... (602) 254-5231
California, Compton ..... (213) 638-7781
California, Los Angeles ..... (213) 482-9660
California, Sunnyvale ..... (408) 735-2191
Colorado, Denver ..... (303) 534-8121
Connecticut, Hartford ..... (203) 246-5441
D.C., Washington ..... (202) 628-8843
Florida, Orlando ..... (305) 425-4511
Georgia, Atlanta ..... (404) 874-1641
Illinois, Chicago ..... (312) 461-7200
Indiana, Indianapolis ..... (317) 632-3301
Maryland, Baltimore ..... (301) 828-5400
Massachusetts, Boston ..... (617) 542-0600
Michigan, Detroit ..... (313) 872-7010
Michigan, Grand Rapids ..... (313) 538-5130
Minnesota, Minneapolis ..... (612) 927-6551
Missouri, St. Louis ..... (314) 421-6911
New Jersey, Newark ..... (201) 621-9000
New Jersey, Red Bank ..... (201) 747-5800
New York, Long Island ..... (516) 248-9800
New York, Johnson City ..... (607) 729-2258
New York, Rochester ..... (716) 232-4380
Ohio, Cleveland ..... (216) 241-7600
Ohio, Dayton ..... (513) 461-3720
Pennsylvania, Philadelphia ..... (215) 382-1200
Pennsylvania, Pittsburgh ..... (412) 391-2800
Texas, Dallas ..... (214) 631-2811
Texas, Houston ..... (713) 224-7791
Washington, Seattle ..... (206) 622-0808
Wisconsin, Milwaukee ..... (414) 276-1800

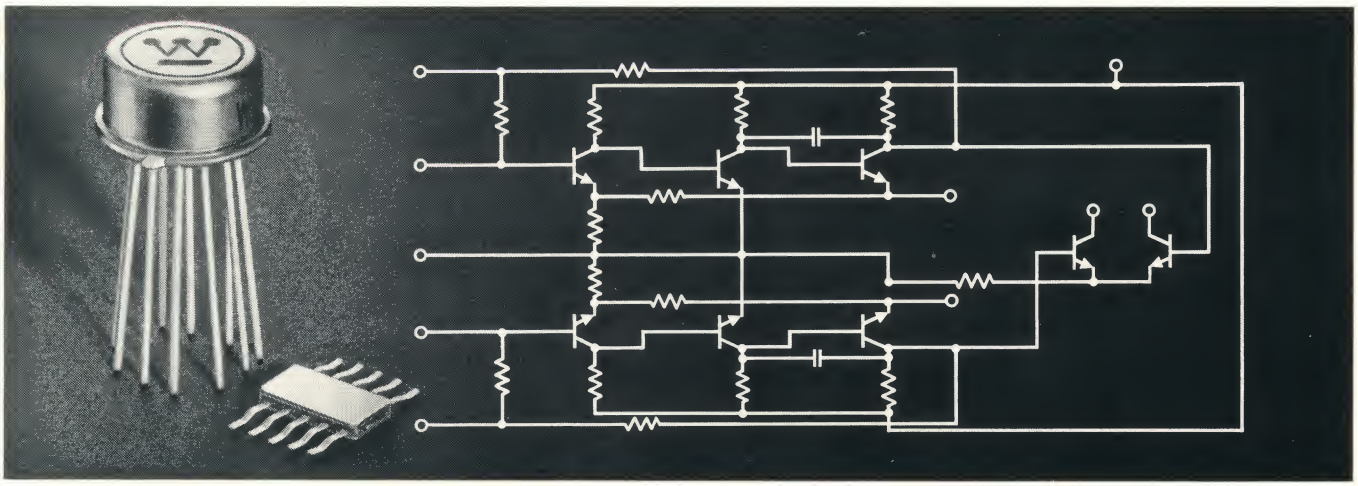
Westinghouse Distributors

Alabama, Birmingham ..... (205) 322-0588
ACK Semiconductors, Inc.
Calif., Los Angeles ..... (213) 870-7171
Hamilton Electro Sales
Calif., Los Angeles ..... (213) 685-7313
K-Tronics
Calif., Mountain View ..... (415) 961-7000
Hamilton Electro Sales — North
Calif., Mountain View ..... (415) 961-3611
Elmar Electronics
Calif., Oakland ..... (415) 834-3311
Elmar Electronics
Calif., San Francisco ..... (415) 826-8811
Fortune Electronics
Conn., Hamden ..... (203) 288-7771
Cramer Electronics, Inc.
D.C., Washington ..... (202) 864-6330
Milgray Electronics, Inc.
Florida, Melbourne ..... (305) 723-1441
Electronic Wholesalers, Inc.
Florida, Orlando ..... (305) 855-4020
Hall-Mark Electronics Corp.
Illinois, Chicago ..... (312) 829-9100
Allied Electronics
Illinois, Chicago ..... (312) 622-8860
Semiconductor Specialists, Inc.
Maryland, Baltimore ..... (301) 889-4242
Kann-Ellert Electronics, Inc.
New Jersey, Camden ..... (609) 964-8560
General Radio Supply Co., Inc.
New York, Binghamton ..... (607) 723-6326
Stack Industrial Electronics
New York, New York ..... (212) 989-1600
Milgray Electronics, Inc.
New York, Westbury ..... (516) 334-7474
Schweber Electronics
Pa., Philadelphia ..... (215) 923-2210
Milgray Electronics, Inc.
Texas, Dallas ..... (214) 276-8531
Hall-Mark Electronics Corp.
Texas, Houston ..... (713) 781-0011
Hall-Mark Electronics Corp.
Washington, Seattle ..... (206) 723-7310
Almac/Stroum Electronics
Canada, Montreal ..... (819) 389-8051
Prelco Electronics, Ltd.

Stop being

This new Westinghouse linear IC can beat discrete in the price-performance tradeoff

so discrete:



New Class B amp gives 94 db gain at 4.5 Vcc, has over 50% efficiency

Here's the best commercially available Class B audio amplifier in silicon! It's the new Westinghouse WC 183. This universal low-level IC audio amplifier gives high gain throughout the Vcc range from 1.5 to 9. Minimum gain with a single battery cell is 60 db.

And here's a stopper...you can buy the WC 183 in TO can or flat package for only $7.50 in quantities of 50!

How does Westinghouse do it? We start the circuit with a three stage Class A preamplifier. There's your high gain. We follow it with a Class B output stage. That gives high efficiency. The entire 8-transistor balanced circuit with internal DC feedback draws only 5 ma. at a minimum output power of 3 mw.

The quiescent current is extremely low too. It's only 0.9 ma. at 1.5 Vcc. This means vastly extended battery life in most applications. It also makes possible a broad range of new battery-powered IC applications.

You'll find the WC 183 ideal for hearing aids, paging systems, dictating equipment, phone amplifiers, and dozens of other voice communication applications. You can also put it to work in phonographs, tape recorders, and other uses where you want flat frequency response extending beyond the audio range.

Reliability? Every chip undergoes storage bake at 150°C, 20,000 G centrifuge, and hermeticity tests. Life tests indicate less than 0.01% failure rate per 1000 hrs.

Send for the specs. You'll think of at least a dozen great ways to use the remarkable WC 183. Write Westinghouse Electric Corporation, Molecular Electronics Division, Box 7377, Elkridge, Maryland 21227. J-09125

You can be sure if it's Westinghouse

nt appears in:
gn—February, 1966

PO 6-7309